

WHAT IS CLAIMED IS:

1. A wide-area high-resolution image generation method comprising the steps of:

a total image acquisition step in which a target object of the generation of a wide-area high-resolution image is captured by a capture device and thereby a total image of the target object is acquired;

an image structure analysis step in which image structure analysis is conducted to the total image of the target object and thereby structural elements are extracted from the total image and position information of each structural element is obtained;

a sub-image acquisition step which is conducted for one or more of the structural elements, in which one or more partial areas and a resolution to be used for capturing the structural element are determined and sub-images of the partial areas of the structural element are acquired by the capture device with the determined resolution;

an image connection step which is conducted for each of the structural elements to which the sub-image acquisition step has been conducted, in which the sub-images of the partial areas of the structural element are connected together by use of image information of the sub-images and thereby an image of the structural element having the determined resolution is obtained as a synthesis target image;

an image extraction step which is conducted for each of the structural elements to which the sub-image acquisition step has not been conducted, in which part of the total image corresponding to the structural element is extracted from the total image as a synthesis target image; and

a wide-area high-resolution image generation step in which the synthesis target images of the structural elements obtained in the image connection steps and the image extraction steps are synthesized so that relative position relationship of the synthesis target images will be the

30 same as that of the structural elements in the total image of the target object based on the position information of the structural elements obtained in the image structure analysis step and thereby a wide-area high-resolution image of the target object is obtained.

2. A wide-area high-resolution image generation method as claimed in claim 1, wherein the wide-area high-resolution image generation method further comprises an attribute determination step in which the attribute of each structural element is determined based on
5 the image structure analysis, and

the sub-image acquisition step is conducted for structural elements having attributes that require higher resolution than that of the total image.

3. A wide-area high-resolution image generation method as claimed in claim 2, wherein:

the wide-area high-resolution image generation method further comprises a resolution judgment step which is conducted for each of the
5 structural elements to which the sub-image acquisition step has been conducted, in which whether or not a sufficient resolution predetermined for the attribute of the structural element could be attained is judged, and

the sub-image acquisition step is repeated with a higher
10 resolution and new partial areas for each of the structural elements that have been judged to have insufficient resolution in the resolution judgment step, until the sufficient resolution predetermined for the attribute is attained, and

the image connection step for the structural element is conducted
15 by use of the sub-images which attained the sufficient resolution.

4. A wide-area high-resolution image generation method as claimed in claim 3, wherein in the resolution judgment step, one or more fine structural elements are extracted from the sub-images of the structural element and the judgment on the resolution is executed based
5 on pixel density of the extracted fine structural elements.

5. A wide-area high-resolution image generation method as claimed in claim 4, wherein one or more letters are extracted as the fine structural elements in the resolution judgment step.

6. A wide-area high-resolution image generation method as claimed in claim 1, further comprising:

a geometrical deformation estimation step in which geometrical deformation is estimated between every two adjoining sub-images of a
5 structural element and thereby geometrical deformation of each sub-image of the structural element is estimated; and

a geometrical deformation compensation step in which the geometrical deformation of each sub-image of the structural element is compensated for based on the geometrical deformation estimated in the
10 geometrical deformation estimation step and thereby deformation-compensated sub-images of the structural element are obtained to be used in the image connection step.

7. A wide-area high-resolution image generation method as claimed in claim 6, wherein in the geometrical deformation estimation step, the estimation of the geometrical deformation between two adjoining sub-images is conducted using one or more fine structural
5 elements extracted from the two adjoining sub-images.

8. A wide-area high-resolution image generation method as

claimed in claim 7, wherein in the geometrical deformation estimation step, one or more letters extracted from the two adjoining sub-images are used as the fine structural elements.

9. A wide-area high-resolution image generation method as claimed in claim 7, wherein in the geometrical deformation estimation step, the estimation of the geometrical deformation between the two adjoining sub-images is conducted by estimating geometrical
5 deformation of each of one or more fine structural elements between the two adjoining sub-images individually and taking the average of the geometrical deformations of the fine structural elements.

10. A wide-area high-resolution image generation method as claimed in claim 4, wherein:

the wide-area high-resolution image generation method further comprises:

5 a geometrical deformation estimation step in which geometrical deformation is estimated between every two adjoining sub-images of a structural element and thereby geometrical deformation of each sub-image of the structural element is estimated; and

10 a geometrical deformation compensation step in which the geometrical deformation of each sub-image of the structural element is compensated for based on the geometrical deformation estimated in the geometrical deformation estimation step and thereby deformation-compensated sub-images of the structural element are obtained to be used in the image connection step, and

15 in the geometrical deformation estimation step, the estimation of the geometrical deformation between two adjoining sub-images is conducted using the fine structural elements extracted in the resolution judgment step.

11. A wide-area high-resolution image generation system comprising a processing device which is connected to a capture device whose capturing direction and zoom ratio are controllable, wherein the processing device includes:

5 a total image acquisition means for capturing a target object of the generation of a wide-area high-resolution image by use of the capture device and thereby acquiring a total image of the target object;

an image structure analysis means for conducting image structure analysis to the total image of the target object and thereby extracting
10 structural elements from the total image and obtaining position information of each structural element;

a sub-image acquisition means which conducts a sub-image acquisition process for one or more of the structural elements, in which one or more partial areas and a resolution to be used for capturing the
15 structural element are determined and sub-images of the partial areas of the structural element are acquired by the capture device with the determined resolution;

an image connection means which conducts an image connection process for each of the structural elements to which the sub-image
20 acquisition process has been conducted, in which the sub-images of the partial areas of the structural element are connected together by use of image information of the sub-images and thereby an image of the structural element having the determined resolution is obtained as a synthesis target image;

25 an image extraction means which conducts an image extraction process for each of the structural elements to which the sub-image acquisition process has not been conducted, in which part of the total image corresponding to the structural element is extracted from the total image as a synthesis target image; and

30 a wide-area high-resolution image generation means for
synthesizing the synthesis target images of the structural elements
obtained in the image connection process and the image extraction
process so that relative position relationship of the synthesis target
images will be the same as that of the structural elements in the total
35 image of the target object based on the position information of the
structural elements obtained by the image structure analysis means and
thereby obtaining a wide-area high-resolution image of the target object.

12. A wide-area high-resolution image generation system as
claimed in claim 11, wherein:

the processing device further includes an attribute determination
means for determining the attribute of each structural element based on
5 the image structure analysis conducted by the image structure analysis
means, and

the sub-image acquisition means conducts the sub-image
acquisition process for structural elements having attributes that require
higher resolution than that of the total image.

13. A wide-area high-resolution image generation system as
claimed in claim 12, wherein:

the processing device further includes a resolution judgment
means which conducts a resolution judgment process for each of the
5 structural elements to which the sub-image acquisition process has been
conducted, in which whether or not a sufficient resolution predetermined
for the attribute of the structural element could be attained is judged,
and

the sub-image acquisition means repeats the sub-image
10 acquisition process with a higher resolution and new partial areas for
each of the structural elements that have been judged to have

insufficient resolution in the resolution judgment process, until the sufficient resolution predetermined for the attribute is attained, and

the image connection means conducts the image connection
15 process for the structural element by use of the sub-images which
attained the sufficient resolution.

14. A wide-area high-resolution image generation system as
claimed in claim 13, wherein the resolution judgment means extracts one
or more fine structural elements from the sub-images of the structural
element and executes the judgment on the resolution based on pixel
5 density of the extracted fine structural elements.

15. A wide-area high-resolution image generation system as
claimed in claim 14, wherein the resolution judgment means extracts one
or more letters as the fine structural elements.

16. A wide-area high-resolution image generation system as
claimed in claim 11, wherein the processing device further includes:

a geometrical deformation estimation means for estimating
geometrical deformation between every two adjoining sub-images of a
5 structural element and thereby estimating geometrical deformation of
each sub-image of the structural element; and

a geometrical deformation compensation means for compensating
for the geometrical deformation of each sub-image of the structural
element based on the geometrical deformation estimated by the
10 geometrical deformation estimation means and thereby obtaining
deformation-compensated sub-images of the structural element to be
used in the image connection process.

17. A wide-area high-resolution image generation system as

claimed in claim 16, wherein the geometrical deformation estimation means conducts the estimation of the geometrical deformation between two adjoining sub-images using one or more fine structural elements
5 extracted from the two adjoining sub-images.

18. A wide-area high-resolution image generation system as claimed in claim 17, wherein the geometrical deformation estimation means uses one or more letters extracted from the two adjoining sub-images as the fine structural elements.

19. A wide-area high-resolution image generation system as claimed in claim 17, wherein the geometrical deformation estimation means conducts the estimation of the geometrical deformation between the two adjoining sub-images by estimating geometrical deformation of
5 each of one or more fine structural elements between the two adjoining sub-images individually and taking the average of the geometrical deformations of the fine structural elements.

20. A wide-area high-resolution image generation system as claimed in claim 14, wherein:

the processing device further includes:

a geometrical deformation estimation means for estimating
5 geometrical deformation between every two adjoining sub-images of a structural element and thereby estimating geometrical deformation of each sub-image of the structural element; and

a geometrical deformation compensation means for compensating for the geometrical deformation of each sub-image of the structural
10 element based on the geometrical deformation estimated by the geometrical deformation estimation means and thereby obtaining deformation-compensated sub-images of the structural element to be

used in the image connection process, and

the geometrical deformation estimation means conducts the
15 estimation of the geometrical deformation between two adjoining
sub-images using the fine structural elements extracted by the resolution
judgment means.

21. A machine-readable record medium storing a program for
instructing a computer, a DSP (Digital Signal Processor), etc. to execute
a wide-area high-resolution image generation process, wherein the
wide-area high-resolution image generation process comprises the steps
5 of:

a total image acquisition step in which a target object of the
generation of a wide-area high-resolution image is captured by a capture
device and thereby a total image of the target object is acquired;

an image structure analysis step in which image structure
10 analysis is conducted to the total image of the target object and thereby
structural elements are extracted from the total image and position
information of each structural element is obtained;

a sub-image acquisition step which is conducted for one or more of
the structural elements, in which one or more partial areas and a
15 resolution to be used for capturing the structural element are
determined and sub-images of the partial areas of the structural element
are acquired by the capture device with the determined resolution;

an image connection step which is conducted for each of the
structural elements to which the sub-image acquisition step has been
20 conducted, in which the sub-images of the partial areas of the structural
element are connected together by use of image information of the
sub-images and thereby an image of the structural element having the
determined resolution is obtained as a synthesis target image;

an image extraction step which is conducted for each of the

25 structural elements to which the sub-image acquisition step has not been
conducted, in which part of the total image corresponding to the
structural element is extracted from the total image as a synthesis target
image; and

30 a wide-area high-resolution image generation step in which the
synthesis target images of the structural elements obtained in the image
connection steps and the image extraction steps are synthesized so that
relative position relationship of the synthesis target images will be the
same as that of the structural elements in the total image of the target
object based on the position information of the structural elements
35 obtained in the image structure analysis step and thereby a wide-area
high-resolution image of the target object is obtained.

22. A machine-readable record medium as claimed in claim 21,
wherein the wide-area high-resolution image generation process further
comprises an attribute determination step in which the attribute of each
structural element is determined based on the image structure analysis,
5 and

the sub-image acquisition step is conducted for structural
elements having attributes that require higher resolution than that of
the total image.

23. A machine-readable record medium as claimed in claim 22,
wherein:

the wide-area high-resolution image generation process further
comprises a resolution judgment step which is conducted for each of the
5 structural elements to which the sub-image acquisition step has been
conducted, in which whether or not a sufficient resolution predetermined
for the attribute of the structural element could be attained is judged,
and

the sub-image acquisition step is repeated with a higher
10 resolution and new partial areas for each of the structural elements that
have been judged to have insufficient resolution in the resolution
judgment step, until the sufficient resolution predetermined for the
attribute is attained, and

the image connection step for the structural element is conducted
15 by use of the sub-images which attained the sufficient resolution.

24. A machine-readable record medium as claimed in claim 23,
wherein in the resolution judgment step, one or more fine structural
elements are extracted from the sub-images of the structural element
and the judgment on the resolution is executed based on pixel density of
5 the extracted fine structural elements.

25. A machine-readable record medium as claimed in claim 24,
wherein one or more letters are extracted as the fine structural elements
in the resolution judgment step.

26. A machine-readable record medium as claimed in claim 21,
wherein the wide-area high-resolution image generation process further
comprises:

a geometrical deformation estimation step in which geometrical
5 deformation is estimated between every two adjoining sub-images of a
structural element and thereby geometrical deformation of each
sub-image of the structural element is estimated; and

a geometrical deformation compensation step in which the
geometrical deformation of each sub-image of the structural element is
10 compensated for based on the geometrical deformation estimated in the
geometrical deformation estimation step and thereby
deformation-compensated sub-images of the structural element are

obtained to be used in the image connection step.

27. A machine-readable record medium as claimed in claim 26, wherein in the geometrical deformation estimation step, the estimation of the geometrical deformation between two adjoining sub-images is conducted using one or more fine structural elements extracted from the
5 two adjoining sub-images.

28. A machine-readable record medium as claimed in claim 27, wherein in the geometrical deformation estimation step, one or more letters extracted from the two adjoining sub-images are used as the fine structural elements.

29. A machine-readable record medium as claimed in claim 27, wherein in the geometrical deformation estimation step, the estimation of the geometrical deformation between the two adjoining sub-images is conducted by estimating geometrical deformation of each of one or more
5 fine structural elements between the two adjoining sub-images individually and taking the average of the geometrical deformations of the fine structural elements.

30. A machine-readable record medium as claimed in claim 24, wherein:

the wide-area high-resolution image generation process further comprises:

5 a geometrical deformation estimation step in which geometrical deformation is estimated between every two adjoining sub-images of a structural element and thereby geometrical deformation of each sub-image of the structural element is estimated; and

a geometrical deformation compensation step in which the

- 10 geometrical deformation of each sub-image of the structural element is compensated for based on the geometrical deformation estimated in the geometrical deformation estimation step and thereby deformation-compensated sub-images of the structural element are obtained to be used in the image connection step, and
- 15 in the geometrical deformation estimation step, the estimation of the geometrical deformation between two adjoining sub-images is conducted using the fine structural elements extracted in the resolution judgment step.